International Journal of Science Education

Contents Index, Volume 31, 2009

Editor-in-Chief **John K. Gilbert,** University of Reading, UK
Editors **Justin Dillon,** King's College London, UK
Gail Jones, North Carolina State University, USA
Rosária Justi, Federal University of Minas Gerais, Brazil
Norman G. Lederman, Illinois Institute of Technology, USA
David F. Treagust, Curtin University of Technology, Australia
Jan Van Driel, Universiteit Leiden, Netherlands

Editorial Board

F. Abd-El-Khalick, University of Illinois-Urbana Champaign, USA
E. Abrams, University of New Hampshire, USA
V. Akerson, University of Indiana, USA
M. Jimenez Aleixandre, University of Santiago de Compostela, Spain
P. Barmby, University of Durham, UK
J. M. Bennett, University of York, UK
K. Boersma, University of Utrecht, The Netherlands
T. Borges, University of Minas Gerais, Brazil
C. Boulter, Institute of Education, University of London, UK
M. Braund, University of York, UK
D. Brown, University of Illinois, USA
M. Brown, Lancing Community College, Michigan, USA
T. Bryce, University of Strathclyde, UK
E. Chiapette, University of Houston, USA
A. Childs, University of Oxford, UK
G. Chittleborough, Deakin University, Australia
R. K. Coll, University of Waikato, New Zealand
C. Constantinou, University of Cyprus, Cyprus
B. Coppola, University of Michigan, USA
D. Couso, Autonomous University of Barcelona, Spain
Z. Dagher, University of Delaware, USA
B. Davidowitz, University of Cape Town, South Africa
V. Dawson, Curtin University of Technology, Australia
O. De Jong, University of Utrecht, The Netherlands
R. Duit, University of Kiel, Germany
S. Erduran, University of Bristol, UK
H. Fischer, University of Duisburg-Essen, Germany
B. France, University of Auckland, New Zealand
M. Goedhart, University of Groningen, The Netherlands
M. Grace, University of Southampton, UK
D. R. Green, University of Aberdeen, UK
M. Hackling, Edith Cowan University, Australia
M. Hammann, University of Münster, Germany
B. Hand, University of Iowa, USA
G. Hellden, University of Kristianstad, Sweden
S. Hsi, The Exploratorium, San Francisco, USA
T. Jarvis, University of Leicester, UK
P. Johnston, University of Durham, UK
A. H. Johnstone, University of Glasgow, UK
A. Jones, University of Waikato, New Zealand
D. Jorde, University of Oslo, Norway
R. Levinson, Institute of Education, University of London, UK
J. Lewis, University of Leeds, UK
J. Loughran, Monash University, Australia
F. Lubben, University of York, UK
R. Millar, University of York, UK
M. Monk, Gatsby Technology Education Project, UK
C. Murphy, Queen's University, Belfast, UK
L. Newton, University of Nottingham, UK
J. Osborne, Graduate School of Education, Stanford University, USA
R. Pinto, Autonomous University of Barcelona, Spain
V. Prain, LaTrobe University, Australia
M. Ratcliffe, University of Southampton, UK
M. Reiner, Technion, Israel
P. Reis, University of Lisbon, Portugal
M. Reiss, Institute of Education, University of London, UK
S. M. Ritchie, Queensland University of Technology, Australia
M. Rollnick, University of the Witwatersrand, South Africa
T. Russell, University of Liverpool, UK
J. Ryder, University of Leeds, UK
N. Sanmarti, University of Barcelona, Spain
E. Savelsbergh, University of Utrecht, The Netherlands
P. Scott, University of Leeds, UK
J. Sharp, Bishop Grosseteste College, Lincoln, UK
S. Simon, Institute of Education, University of London, UK
L. Simonneaux, Ecole National de Formation Agronomique, France
S. M. Stocklmayer, Australian National University, Australia
E. Sumfleth, University of Duisberg-Essen, Germany
K. Taber, University of Cambridge, UK
D. Tan, Nanyang Technological University, Singapore
P. Taylor, Curtin University of Technology, Australia
D. Trumbull, Cornell University, USA
C.-C. Tsai, National Taiwan University of Science and Technology, Taiwan.
G. Tsaparlis, University of Ioannina, Greece
R. Tytler, Deakin University, Australia
C.-Y. Tsui, Hong Kong
W. Van Joolingen, University of Twente, The Netherlands
J. Van Den Akker, University of Twente, The Netherlands
E. Van Den Berg, University of Amsterdam, The Netherlands
G. Venville, University of Western Australia, Australia
C. Von Aufschnaiter, Justus Liebig University, Germany
B. Waldrip, University of Southern Queensland, Australia
J. Watters, Queensland University of Technology, Australia
D. M. Watts, Brunel University, UK
K. White, Illinois Institute of Technology, USA
B.-H. Zhang, National Institute of Education, Singapore
A. Zylbersztajn, University of Santa Catarina, Brazil

International Journal of Science Education

Contents Index, Volume 31, 2009

Editor-in-Chief **John K. Gilbert,** University of Reading, UK
Editors **Justin Dillon,** King's College London, UK
Gail Jones, North Carolina State University, USA
Rosária Justi, Federal University of Minas Gerais, Brazil
Norman G. Lederman, Illinois Institute of Technology, USA
David F. Treagust, Curtin University of Technology, Australia
Jan Van Driel, Universiteit Leiden, Netherlands

Editorial Board

F. Abd-El-Khalick, University of Illinois-Urbana Champaign, USA
E. Abrams, University of New Hampshire, USA
V. Akerson, University of Indiana, USA
M. Jimenez Aleixandre, University of Santiago de Compostela, Spain
P. Barmby, University of Durham, UK
J. M. Bennett, University of York, UK
K. Boersma, University of Utrecht, The Netherlands
T. Borges, University of Minas Gerais, Brazil
C. Boulter, Institute of Education, University of London, UK
M. Braund, University of York, UK
D. Brown, University of Illinois, USA
M. Brown, Lancing Community College, Michigan, USA
T. Bryce, University of Strathclyde, UK
E. Chiapette, University of Houston, USA
A. Childs, University of Oxford, UK
G. Chittleborough, Deakin University, Australia
R. K. Coll, University of Waikato, New Zealand
C. Constantinou, University of Cyprus, Cyprus
B. Coppola, University of Michigan, USA
D. Couso, Autonomous University of Barcelona, Spain
Z. Dagher, University of Delaware, USA
B. Davidowitz, University of Cape Town, South Africa
V. Dawson, Curtin University of Technology, Australia
O. De Jong, University of Utrecht, The Netherlands
R. Duit, University of Kiel, Germany
S. Erduran, University of Bristol, UK
H. Fischer, University of Duisburg-Essen, Germany
B. France, University of Auckland, New Zealand
M. Goedhart, University of Groningen, The Netherlands
M. Grace, University of Southampton, UK
D. R. Green, University of Aberdeen, UK
M. Hackling, Edith Cowan University, Australia
M. Hammann, University of Münster, Germany
B. Hand, University of Iowa, USA
G. Hellden, University of Kristianstad, Sweden
S. Hsi, The Exploratorium, San Francisco, USA
T. Jarvis, University of Leicester, UK
P. Johnston, University of Durham, UK
A. H. Johnstone, University of Glasgow, UK
A. Jones, University of Waikato, New Zealand
D. Jorde, University of Oslo, Norway
R. Levinson, Institute of Education, University of London, UK
J. Lewis, University of Leeds, UK
J. Loughran, Monash University, Australia
F. Lubben, University of York, UK
R. Millar, University of York, UK
M. Monk, Gatsby Technology Education Project, UK
C. Murphy, Queen's University, Belfast, UK
L. Newton, University of Nottingham, UK
J. Osborne, Graduate School of Education, Stanford University, USA
R. Pinto, Autonomous University of Barcelona, Spain
V. Prain, LaTrobe University, Australia
M. Ratcliffe, University of Southampton, UK
M. Reiner, Technion, Israel
P. Reis, University of Lisbon, Portugal
M. Reiss, Institute of Education, University of London, UK
S. M. Ritchie, Queensland University of Technology, Australia
M. Rollnick, University of the Witwatersrand, South Africa
T. Russell, University of Liverpool, UK
J. Ryder, University of Leeds, UK
N. Sanmarti, University of Barcelona, Spain
E. Savelsbergh, University of Utrecht, The Netherlands
P. Scott, University of Leeds, UK
J. Sharp, Bishop Grosseteste College, Lincoln, UK
S. Simon, Institute of Education, University of London, UK
L. Simonneaux, Ecole National de Formation Agronomique, France
S. M. Stocklmayer, Australian National University, Australia
E. Sumfleth, University of Duisberg-Essen, Germany
K. Taber, University of Cambridge, UK
D. Tan, Nanyang Technological University, Singapore
P. Taylor, Curtin University of Technology, Australia
D. Trumbull, Cornell University, USA
C.-C. Tsai, National Taiwan University of Science and Technology, Taiwan.
G. Tsaparlis, University of Ioannina, Greece
R. Tytler, Deakin University, Australia
C.-Y. Tsui, Hong Kong
W. Van Joolingen, University of Twente, The Netherlands
J. Van Den Akker, University of Twente, The Netherlands
E. Van Den Berg, University of Amsterdam, The Netherlands
G. Venville, University of Western Australia, Australia
C. Von Aufschnaiter, Justus Liebig University, Germany
B. Waldrip, University of Southern Queensland, Australia
J. Watters, Queensland University of Technology, Australia
D. M. Watts, Brunel University, UK
K. White, Illinois Institute of Technology, USA
B.-H. Zhang, National Institute of Education, Singapore
A. Zylbersztajn, University of Santa Catarina, Brazil

Volume 31 Number 1 1 January 2009

RESEARCH REPORTS

Assessing Assessment: Examination of pre-service physics teachers' attitudes towards assessment and factors affecting their attitudes
Feral Ogan-Bekiroglu 1

Drawings as Representations of Children's Conceptions
Karin Ehrlén 41

Shadows: Young Taiwanese children's views and understanding
Shu-Min Chen 59

Identifying a Gender-inclusive Pedagogy from Maltese Teachers' Personal Practical Knowledge
Deborah Chetcuti 81

Children's Typically-Perceived-Situations of Floating and Sinking
Yong Jae Joung 101

Staff Members' Ideas about Visitors' Learning at Science and Technology Centres
Eva Davidsson and Anders Jakobsson 129

Book Review 147

Volume 31 Number 2 15 January 2009

RESEARCH REPORTS

What do Students Gain from a Week at Science Camp? Youth perceptions and the design of an immersive, research-oriented astronomy camp
Deborah Anne Fields 151

Patterns of Linguistic Communication in Teaching and Learning Science: A case study of Korean middle school science classes
Eunsun Ha and Jinwoong Song 173

A Model of Factors Determining Students' Ability to Interpret External Representations in Biochemistry
Konrad J. Schönborn and Trevor R. Anderson 193

Identifying Atomic Structure as a Threshold Concept: Student mental models and troublesomeness
Eun Jung Park and Gregory Light 233

In Search of Meaningful Integration: The experiences of developing integrated science curricula in junior secondary schools in China
Bing Wei 259

Moral Sensitivity in the Context of Socioscientific Issues in High School Science Students
Samantha R. Fowler, Dana L. Zeidler and Troy D. Sadler 279

Volume 31 Number 3 1 February 2009

Special issue: **Visual and Spatial Modes in Science Learning**

Guest Editor: **Jayashree Ramadas**

EDITORIAL

Introduction to the Special Issue on "Visual and Spatial Modes in Science Learning"
Jayashree Ramadas 297

RESEARCH REPORTS

Visual and Spatial Modes in Science Learning
Jayashree Ramadas 301

Drawing, Visualisation and Young Children's Exploration of "Big Ideas"
Margaret Brooks 319

Sensory Cues, Visualization and Physics Learning
Miriam Reiner 343

How Students and Field Geologists Reason in Integrating Spatial Observations from Outcrops to Visualize a 3-D Geological Structure
Kim A. Kastens, Shruti Agrawal and Lynn S. Liben 365

Visualisation and Reasoning in Explaining the Phases of the Moon
K. Subramaniam and Shamin Padalkar 395

Spatial Learning and Computer Simulations in Science
Robb Lindgren and Daniel L. Schwartz 419

Visuals and Visualisation of Human Body Systems
Sindhu Mathai and Jayashree Ramadas 439

Educational Research in Developing 3-D Spatial Skills for Engineering Students
Sheryl A. Sorby 459

Volume 31 Number 4 1 March 2009

RESEARCH REPORTS

The Environmental Attitudes of Turkish Senior High School Students in the Context of Postmaterialism and the New Environmental Paradigm
Ozgur Taskin 481

Cognitive Pathways: Analysis of students' written texts for science understanding
Bruna Irene Grimberg and Brian Hand 503

Knowing More than Words Can Say: Using multimodal assessment tools to excavate and construct knowledge about wolves
Barbara O'Byrne 523

Essential Criteria to Characterize Constructivist Teaching: Derived from a review of the literature and applied to five constructivist-teaching method articles
Sandhya N. Baviskar, R. Todd Hartle and Tiffany Whitney 541

Developing High Quality Decision-Making Discussions About Biological Conservation in a Normal Classroom Setting
Marcus Grace 551

Teaching Refugee Learners with Interrupted Education in Science: Vocabulary, literacy and pedagogy
Jennifer Miller 571

Book Reviews 593

Volume 31 Number 5 15 March 2009

RESEARCH REPORTS

Learning of Chemical Equilibrium through Modelling-based Teaching
Poliana Flávia Maia and Rosária Justi 603

Development and Use of a Conceptual Survey in Introductory Quantum Physics
Sura Wuttiprom, Manjula Devi Sharma, Ian D. Johnston, Ratchapak Chitaree and Chernchok Soankwan 631

An Investigation of the Potential of Interactive Simulations for Developing System Thinking Skills in Elementary School: A case study with fifth-graders and sixth-graders
Maria Evagorou, Kostas Korfiatis, Christiana Nicolaou and Costas Constantinou 655

Same Science for All? Interactive association of structure in learning activities and academic attainment background on college science performance in the USA
Robert H. Tai and Philip M. Sadler 675

Metamodelling Messages Conveyed in Five Statistical Mechanical Textbooks from 1936 to 2001
Martin Niss 697

Book Review 721

Volume 31 Number 6 1 April 2009

RESEARCH REPORTS

Scientists' Habits of Mind as Evidenced by the Interaction Between their Science Training and Religious Beliefs
Richard K. Coll, Neil Taylor and Mark C. Lay 725

Learne' Mental Models of the Particle Nature of Matter: A study of 16-year-old Swedish science students
Karina Adbo and Keith S. Taber 757

Multiple Representation in Learning About Evaporation
Vaughan Prain, Russell Tytler and Suzanne Peterson 787

Action-research and Food and Nutrition Security: A school experience mediated by conceptual graphic representation tool
Ivete Teresinha Graebner, Elizabeth Maria Talá de Souza and Carlos Hiroo Saito 809

Scaffolding Science Teachers in Open-inquiry Teaching
Ton van der Valk and Onno de Jong 829

Erratum 851

Volume 31 Number 7 1 May 2009

RESEARCH REPORTS

Evaluating Elementary and Secondary School Science Learning Environments in Taiwan
Jing-Ru Wang and Sheau-Wen Lin 853

A Study of How Classroom Dialogue Facilitates the Development of Geometric Spatial Concepts Related to Understanding the Cause of Moon Phases
Sonya Ellouise Sherrod and Jennifer Wilhelm 873

High-school Students' Conceptual Difficulties and Attempts at Conceptual Change: The case of basic quantum chemical concepts
Georgios Tsaparlis and Georgios Papaphotis 895

Science Teachers' Inspiration for Teaching Socio-scientific Issues: Disconnection with reform efforts
Hyunju Lee and Klaus G. Witz 931

The Nature of Relationships among the Components of Pedagogical Content Knowledge of Preservice Science Teachers: 'Ozone layer depletion' as an example
Osman N. Kaya 961

Book Review 989

Volume 31 Number 8 15 May 2009

RESEARCH REPORTS

ICT in Science Education: A quasi-experimental study of achievement, attitudes toward science, and career aspirations of Korean middle school students
HyeRan Park, Samia Khan and Stephen Petrina 993

The Interplay of the Classroom Learning Environment and Inquiry-based Activities
Huann-shyang Lin, Zuway-R Hong and Ying-Yao Cheng 1013

How Young Children Understand Electric Circuits: Prediction, explanation and exploration
Esme Bridget Glauert 1025

Avoidance from Thought Experiments: Fear of misconception
Omer Faruk Ozdemir 1049

Supporting Scientific Conceptual Consciousness or Learning in 'a Roundabout Way' in Play-based Contexts
Marilyn Fleer 1069

Bridging Realty to Virtual Reality: Investigating gender effect and student engagement on learning through video game play in an elementary school classroom
Leonard Annetta, Jennifer Mangrum, Shawn Holmes, Kimberly Collazo and Meng-Tzu Cheng 1091

How Choosing Science depends on Students' Individual Fit to 'Science Culture'
Ruurd Taconis and Ursula Kessels 1115

Book Review 1133

Volume 31 Number 9 1 June 2009

RESEARCH REPORTS

The Relationship between Students' Views of the Nature of Science and their Views of the Nature of Scientific Measurement
Andy Buffler, Fred Lubben and Bashirah Ibrahim 1137

Student Misapplication of a Gas-like Model to Explain Particle Movement in Heated Solids: Implications for curriculum and instruction towards students' creation and revision of accurate explanatory models
Jana Bouwma-Gearhart, James Stewart and Keffrelyn Brown 1157

Temperament Characteristics and Science Achievement: A longitudinal study of elementary students in Taiwan
Ishien Li, Esther Onaga, Pao-Sheng Shen and Hua-Huei Chiou 1175

Typical Didactical Activities in the Greek Early-Years Science Classroom: Do they promote science learning?
Maria Kallery, Dimitris Psillos and Vassilis Tselfes 1187

The Relation between Students' Epistemological Understanding of Computer Models and their Cognitive Processing on a Modelling Task
Patrick H. M. Sins, Elwin R. Savelsbergh, Wouter R. van Joolingen and Bernadette H. A. M. van Hout-Wolters 1205

Proportional Reasoning Ability and Concepts of Scale: Surface area to volume relationships in science
Amy Taylor and Gail Jones 1231

Lenses for Framing Decisions: Undergraduates' decision making about stem cell research
Kristy Lynn Halverson, Marcelle A. Siegel and Sharyn K. Freyermuth 1249

Book Review 1269

Erratum 1277

Volume 31 Number 10 1 July 2009

RESEARCH REPORTS

First-year Biology Students' Understandings of Meiosis: An investigation using a structural theoretical framework
Frances Quinn, John Pegg and Debra Panizzon 1279

Using Concept Cartoons in Formative Assessment: Scaffolding students' argumentation
Christine Chin and Lay-Yen Teou 1307

College Students' Conceptions of Chemical Stability: The widespread adoption of a heuristic rule out of context and beyond its range of application
Keith S. Taber 1333

Measuring the Impact of Haptic Feedback Using the SOLO Taxonomy
James Minogue and Gail Jones 1359

An Assessment of Factors Related to Science Achievement of Turkish Students
Ilker Kalender and Giray Berberoglu 1379

Influence of Content Knowledge on Pedagogical Content Knowledge: The case of teaching photosynthesis and plant growth
Markku Käpylä, Jussi-Pekka Heikkinen and Tuula Asunta 1395

Book Review 1417

Volume 31 Number 11 15 July 2009

RESEARCH REPORTS

High-school Students' Informal Reasoning and Argumentation about Biotechnology: An indicator of scientific literacy?
Vaille Dawson and Grady Jane Venville 1421

Water Transformation and Storage in the Mountains and at the Coast: Midwest students' disconnected conceptions of the hydrologic cycle
Daniel P. Shepardson, Bryan Wee, Michelle Priddy, Lauren Schellenberger and Jon Harbor 1447

An Integrative Perspective on Students' Proportional Reasoning in High School Physics in a West African Context
Ayo Harriet Akatugba and John Wallace 1473

Estimating Linear Size and Scale: Body rulers
Gail Jones, Amy Taylor and Bethany Broadwell 1495

Comparison of Two Small-group Learning Methods in 12th-grade Physics Classes Focusing on Intrinsic Motivation and Academic Performance
Roland Berger and Martin Hänze 1511

A Conflict in Your Head: An exploration of trainee science teachers' subject matter knowledge development and its impact on teacher self-confidence
Vanessa Kind 1529

Book Review 1563

Corrigendum 1566

Volume 31 Number 12 1 August 2009

List of Reviewers
International Journal of Science Education in 2008 1567

RESEARCH REPORTS

A Cross-age Study of Children's Knowledge of Apparent Celestial Motion
Julia D. Plummer 1571

Evaluation of Three Primary Teachers' Approaches to Teaching Scientific Concepts in Persuasive Ways
Peter Michael Loxley 1607

A Longitudinal Study Showing how Students use a Molecule Concept when Explaining Everyday Situations
Lena Löfgren and Gustav Helldén 1631

Contribution of Meta-strategic Knowledge to Scientific Inquiry Learning
Adi Ben-David and Anat Zohar 1657

The Role of Narrative in Communicating Science
Lucy Avraamidou and Jonathan Osborne 1683

Book Review 1709

Volume 31 Number 13 1 September 2009

RESEARCH REPORTS

Reliance to Independence: Approaches to learning in peer-led undergraduate science, technology, engineering, and mathematics workshops
Marina Micari and Gregory Light 1713

Impacts of Multi-representational Instruction on High School Students' Conceptual Understandings of the Particulate Nature of Matter
Emine Adadan, Karen E. Irving and Kathy C. Trundle 1743

School Innovation in Science: Improving science teaching and learning in Australian schools
Russell Tytler 1777

Exploring Taiwanese High School Students' Perceptions of and Preferences for Teacher Authority in the Earth Science Classroom with Relation to their Attitudes and Achievement
Min-Hsien Lee, Chun-Yen Chang and Chin-Chung Tsai 1811

Students' Perspectives of a Science Enrichment Programme: Out-of-school inquiry as access
April Lynn Luehmann 1831

Volume 31 Number 14 15 September 2009

RESEARCH REPORTS

Interdisciplinary Mathematics–Physics Approaches to Teaching the Concept of Angle in Elementary School
Valérie Munier and Helene Merle 1857

Analysing Concept Maps as an Assessment Tool in Teaching Physics and Comparison with the Achievement Tests
Şebnem Kandil İngeç 1897

Secondary Students' Thinking about Familiar Phenomena: Learners' explanations from a curriculum context where 'particles' is a key idea for organising teaching and learning
Alejandra García Franco and Keith S. Taber 1917

Children's Self-documentation and Understanding of the Concepts 'Healthy' and 'Unhealthy'
Suzanne Reeve and Philip Bell 1953

Would You Want to Talk to a Scientist at a Party? High school students' attitudes to school science and to science
Judith Bennett and Sylvia Hogarth 1975

Volume 31 Number 15 1 October 2009

RESEARCH REPORTS

Research Trends in Science Education from 2003 to 2007: A content analysis of publications in selected journals
Min-Hsien Lee, Ying-Tien Wu and Chin-Chung Tsai 1999

Coordinating Procedural and Conceptual Knowledge to Make Sense of Word Equations: Understanding the complexity of a 'simple' completion task at the learner's resolution
Keith S. Taber and Pat Bricheno 2021

Education through Fiction: Acquiring opinion-forming skills in the context of genomics
Marie-Christine P. J. Knippels, Sabine E. Severiens and Tanja Klop 2057

Students' Understanding of the Special Theory of Relativity and Design for a Guided Visit to a Science Museum
Jenaro Guisasola, Jordi Solbes, José-Ignacio Barragues, Maite Morentin and Antonio Moreno 2085

Gender Differences in Lunar-related Scientific and Mathematical Understandings
Jennifer Wilhelm 2105

On Cognitive Constraints and Learning Progressions: The case of "structure of matter"
Vicente Talanquer 2123

Volume 31 Number 16 1 November 2009

RESEARCH REPORTS

Scientific Processes in PISA Tests Observed for Science Teachers
Roser Pinto and Samira El Boudamoussi 2137

The Influence of Metacognitive Training on Preservice Elementary Teachers' Conceptions of Nature of Science
Fouad Abd-El-Khalick and Valarie Akerson 2161

Developing a Scale to Measure Students' Attitudes toward Chemistry Lessons
Derek Cheung 2185

Introduction to Semiconductor Physics in Secondary Education: Evaluation of a teaching sequence
Antonio García-Carmona and Ana María Criado 2205

Science through Drama: A multiple case exploration of the characteristics of drama activities used in secondary science lessons
Kirk Robert Dorion 2247

Book Review 2271

Volume 31 Number 17 15 November 2009

RESEARCH REPORTS

Design-based Research: Case of a teaching sequence on mechanics
Andree Tiberghien, Jacques Vince and Pierre Gaidioz 2275

Exploring Secondary Science Teachers' Perceptions on the Goals of Earth Science Education in Taiwan
Chun-Yen Chang, Yueh-Hsia Chang and Fang-Ying Yang 2315

Does Practical Work Really Motivate? A study of the affective value of practical work in secondary school science
Ian Abrahams 2335

Beginning Secondary Science Teachers in Different Induction Programmes: The first year of teaching
Julie A. Luft 2355

The Effects of Dichotomous Attitudes toward Science on Interest and Conceptual Understanding in Physics
Minkee Kim and Jinwoong Song 2385

Book Review 2407

Volume 31 Number 18 1 December 2009

RESEARCH REPORTS

Embedded Assessment in Project-based Science Courses for the Gifted: Insights to inform teaching all students
Shirley Miedijensky and Tali Tal 2411

Developing, Evaluating and Demonstrating the Use of a Conceptual Survey in Mechanical Waves
Apisit Tongchai, Manjula D. Sharma, Ian D. Johnston, Kwan Arayathanitkul and Chernchok Soankwan 2437

A National Science Fair: Exhibiting support for the knowledge economy
John Lawrence Bencze and Gervase Michael Bowen 2459

Pupils' Image of 'the Scientist' among Two Communities in Israel: A comparative study
Pazit Koren and Varda Bar 2485

What Does the Skill of Observation Look Like in Young Children?
Jane Susan Johnston 2511

Does Prior Knowledge Matter? Do Lamarckian misconceptions exist? A critique of Geraedts and Boersma (2006)
Patrick J. Enderle, Mike U. Smith and Sherry Southerland 2527

Contents of Volume 31, 2009 2533